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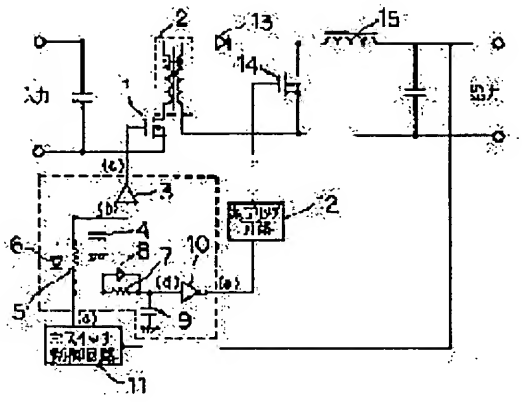
(54) POWER SUPPLY CIRCUIT

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent generation of power loss due to simultaneous ON with a main switch which is caused by the operation delay of a commutation side MOSFET, in a power supply circuit in which MOSFET's are used in a synchronous rectification circuit.



SOLUTION: In a driving control circuit of a synchronous rectification circuit using MOSFET's in a power supply circuit, a series circuit of a first time constant circuit and an IC for driving is connected with a main switch 1, and a series circuit of a second time constant circuit and an inverter 10 is connected with a synchronous rectifier 14 via a coupling circuit 12. The first time constant circuit is constituted of a resistor 5, a capacitor 3 and a diode 6. The second time constant circuit is constituted of a resistor 7, a capacitor 9 and a diode 8. By the first time constant circuit and the IC 3 for driving or by the second time constant circuit and the inverter 10, a dead time is formed between a driving pulse of the main switch 1 and a driving pulse of the synchronous rectifier 14. Thereby the state of simultaneous ON is eliminated, and power loss due to driving is improved.

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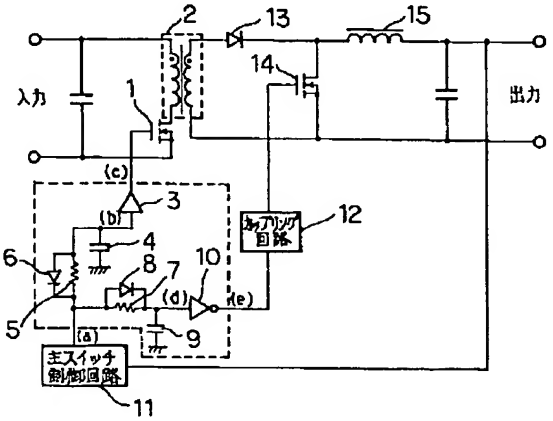
(54)【発明の名称】　電源回路

(57)【要約】

【課題】　ＭＯＳＦＥＴを同期整流回路に用いた電源回路において、転流側ＭＯＳＦＥＴの動作遅れによる主スイッチとの同時オンによる電力損失を防ぐ。

【解決手段】　電源回路におけるＭＯＳＦＥＴを用いた同期整流回路の駆動制御回路において、主スイッチ１及び同期整流器１４にそれぞれ抵抗器５、コンデンサ４、ダイオード６で構成されている第１の時定数回路と駆動用ＩＣ３の直列回路を主スイッチ１に接続する。また、抵抗器７、コンデンサ９、ダイオード８で構成されている第２の時定数回路と反転器１０の直列回路をカップリング回路１２を経由し、同期整流器１４に接続する。この時、第１の時定数回路と駆動用ＩＣまたは第２の時定数回路と反転器により主スイッチと同期整流器の駆動パルス間にデッドタイムを作ることにより同時オン状態を無くし、駆動による電力損失を改善する。



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【特許請求の範囲】

【請求項１】　ＭＯＳＦＥＴを整流用として用いたスイッチング電源の主スイッチと、転流側ＭＯＳＦＥＴの同期整流器と、主スイッチ制御回路を含む駆動制御回路を有する電源回路において、

駆動回路を経由し前記主スイッチに接続され、前記主スイッチ制御回路の基準パルスを入力信号とする第１の時定数回路と、

反転回路を経由し前記同期整流器に接続され、前記主スイッチ制御回路の基準パルスを入力信号とする第２の時定数回路とを有し、

前記基準パルスを２相に分割し、それぞれ前記主スイッチと前記同期整流器とを駆動する駆動パルス間に休止期間を設けることを特徴とする電源回路。

【請求項２】　抵抗器とコンデンサを含む前記第１の時定数回路が、

前記抵抗器と並列にダイオードを接続し、前記基準パルスの後縁で急激に放電させる第１の時定数回路を有する請求項１に記載の電源回路。

【請求項３】　抵抗器とコンデンサを含む前記第２の時定数回路が、

前記抵抗器と並列にダイオードを接続し、前記基準パルスの前縁で急激に充電させる第２の時定数回路を有する請求項１に記載の電源回路。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ＭＯＳＦＥＴの同期整流による電源回路に関し、特に転流側の同期整流器の駆動方法による電源回路に関する。

【０００２】

【従来の技術】まず、従来の一般的なＭＯＳＦＥＴを整流用として用いたスイッチング電源の主スイッチと、転流側ＭＯＳＦＥＴの同期整流器と、主スイッチ制御回路を含む駆動制御回路を有する電源回路の一例を図３に示す。

【０００３】主スイッチ制御回路４の基準パルスはカップリング回路５に入力され、反転器６及び同期整流駆動回路７を経由し、転流側ＭＯＳＦＥＴ９のゲートに入力される。転流側ＭＯＳＦＥＴ９の駆動パルスは、主スイッチ制御回路４の基準パルスを反転器６を介すことによりその動作は基準パルスに同期し、且つ、主スイッチ１の駆動パルスと全く逆の動作を行う。従って、主スイッチ１がオンの時、転流側ＭＯＳＦＥＴ９はオフ状態となり、整流ダイオード８を介して電源の入力側から出力側へエネルギーが供給される。また、主スイッチ１がオフの時、整流ダイオード８がオフ状態となり、転流側ＦＥＴ９はオン状態になることによりチョークコイル１０より出力側へエネルギーが供給される。

【０００４】

【発明が解決しようとする課題】上述した従来の駆動制御回路においては、主スイッチの動作と転流側の同期整流器の動作とを正反対の動作にさせるため反転器が用いられているが、その反転器の動作による遅れや、同期整流器として使用するＭＯＳＦＥＴのゲートの寄生容量による動作遅れにより、主スイッチと転流側ＭＯＳＦＥＴの同期整流器が同時にオン状態になる現象が起こり、電源回路の電力変換効率が低下する問題があった。

【０００５】本発明の目的はＭＯＳＦＥＴを整流用として用いたスイッチング電源の主スイッチと、転流側同期整流用ＭＯＳＦＥＴと、駆動制御回路を有する電源回路において、転流側ＭＯＳＦＥＴの動作遅れによる主スイッチとの同時オン状態による電力損失を防ぐ電源回路を提供することである。

【０００６】

【課題を解決するための手段】本発明の電源回路は、ＭＯＳＦＥＴを整流用として用いたスイッチング電源の主スイッチと、転流側ＭＯＳＦＥＴの同期整流器と、主スイッチ制御回路を含む駆動制御回路を有する電源回路において、駆動回路を経由し前記主スイッチに接続され、前記主スイッチ制御回路の基準パルスを入力信号とする第１の時定数回路と、反転回路を経由し前記同期整流器に接続され、前記主スイッチ制御回路の基準パルスを入力信号とする第２の時定数回路とを有し、前記基準パルスを２相に分割し、それぞれ前記主スイッチと前記同期整流器とを駆動する駆動パルス間に休止期間を設けることを特徴とする。

【０００７】また、抵抗器とコンデンサを含む前記第１の時定数回路が、前記抵抗器と並列にダイオードを接続し、前記基準パルスの後縁で急激に放電させる第１の時定数回路を有する。

【０００８】また、抵抗器とコンデンサを含む前記第２の時定数回路が、前記抵抗器と並列にダイオードを接続し、前記基準パルスの前縁で急激に充電させる第２の時定数回路を有する。

【０００９】すなわち、本発明の電源回路は、主スイッチ制御回路からの基準パルスを主スイッチ及び転流側ＭＯＳＦＥＴの同期整流器にそれぞれ時定数回路を設け、その基準パルスを駆動制御回路により矩形波に整形して駆動パルスとし、各駆動パルスの波形間にデッドタイムを設ける時定数回路を有している。

【００１０】

【発明の実施の形態】次に本発明について図面を参照して説明する。

【００１１】図１は、本発明の一実施例を示す回路図である。また、図２は図１に示した各部波形である。この実施例において図３に示した従来例のものと異なる点は主スイッチ制御回路１１から出力される基準パルスをダイオード６、抵抗器５、コンデンサ４からなる時定数回路に接続し、そして、その出力を駆動用ＩＣ３と主スイッチ１のゲートの直列回路に接続する。更に、主スイッ

チ制御回路１１から出力される基準パルスをダイオード８、抵抗器７、コンデンサ９からなる時定数回路にも接続し、その出力を反転器１０、カップリング回路１２、転流側ＭＯＳＦＥＴ１４のゲートの直列回路に接続することにより、主スイッチ１及び転流側ＭＯＳＦＥＴの同期整流器１４の駆動パルスを矩形波にし、それぞれにデッドタイムを設けることである。

【００１２】次に上記実施例の電源回路の動作を図２を用いて説明する。図２（ａ）は主スイッチ制御回路１１の基準パルス波形、（ｂ）は駆動用ＩＣ３の入力波形、（ｃ）は主スイッチ１のゲート電圧波形、（ｄ）は反転器１０の入力波形、（ｅ）同期整流器１４のゲート波形である。ここで、主スイッチ制御回路１１の基準パルスがＨｉになると抵抗器５、コンデンサ４の時定数により図２－（ｂ）のような波形が駆動用ＩＣ３に入力される。更に、駆動用ＩＣ３により矩形波に成形されこのパルス波形により、主スイッチ１がオン状態になる。また、このとき主スイッチ制御回路１１の基準パルス波形（ｂ）はダイオード８、反転器１０及びカップリング回路１２により同期整流素子１４をオフ状態にする。

【００１３】一方、主スイッチ制御回路１１の基準パルスがＬｏになるとコンデンサ４に蓄えられたエネルギーがダイオード６を経由し放電されるため、駆動用ＩＣ３の出力波形がＬｏとなり、主スイッチ１はオフ状態になる。その時、反転器１０の入力はコンデンサ９、抵抗器７の時定数により図２－（ｄ）に示す放電波形になり、反転器１０を経由し矩形波に成形され、このパルスにより転流側ＭＯＳＦＥＴの同期整流器１４はオン状態になる。

【００１４】以上の動作により、本実施例においては、主スイッチ１と転流側ＭＯＳＦＥＴの同期整流器１４の駆動パルスのタイミングを抵抗器５、コンデンサ４及び抵抗器７、コンデンサ９によって設定することにより両ＭＯＳＦＥＴの同時オン状態を防ぐことができ、矩形波により同期整流器を駆動するために、安定動作が可能となり、駆動による電力損失を改善できる。また、デッドタイムは、主スイッチ制御回路の基準パルスが変化しても転流側ＭＯＳＦＥＴの駆動パルスも主スイッチ駆動回路の基準パルスに追従するため、電源の入力条件及び負荷条件によらず一定になり、入力変動の影響を受けず駆動電力は一定となる。

【００１５】

【発明の効果】以上述べたように、本発明の電源回路は、主スイッチ制御回路の基準パルスを時定数回路と駆動用ＩＣ、または、時定数回路と反転器の組合せによりデッドタイムを作り、主スイッチ及び同期整流器を駆動する駆動制御回路を備えているので、前記の両ＭＯＳＦＥＴがデッドタイムにより同時オン状態（短絡状態）になるのを防ぐことによる電力損失を無くし、且つ入力条件や負荷条件に左右されることなく安定して動作すると言う効果がある。

【図面の簡単な説明】

【図１】本発明の一実施例の電源回路を示す構成図である。

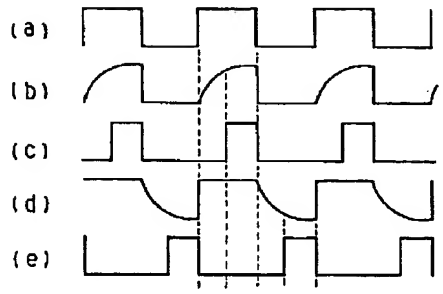
【図２】図１の各部の波形を示す図である。

【図３】従来例の電源回路を示す構成図を示す図である。

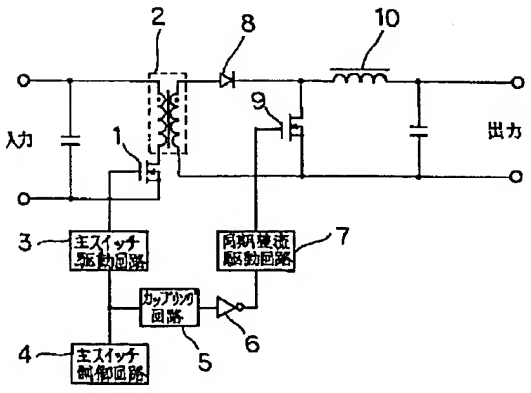
【符号の説明】

１	主スイッチ
２	主トランス
３	駆動用ＩＣ
４、９	コンデンサ
５、７	抵抗器
６、８	ダイオード
１０	反転器
１１	主スイッチ制御回路
１２	カップリング回路
１３	ダイオード
１４	同期整流器
１５	主チョークコイル

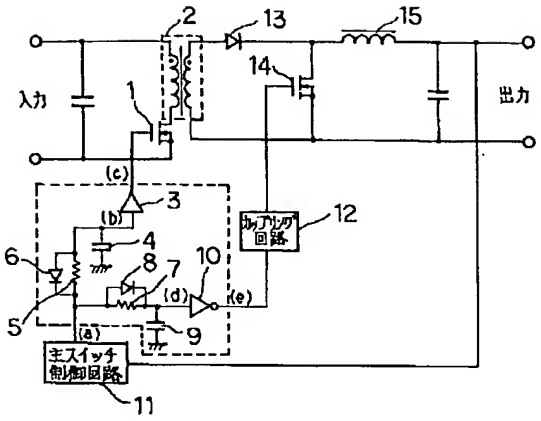
【図２】



【図３】



【図1】



Japanese Patent Application Publication No. 09-285116

CLAIMS

[Claim(s)]

[Claim 1] A main switch of switching power supply using MOSFET as an object for rectification A synchronous detector by the side of [MOSFET] commutation, and an actuation control circuit including a main-switch control circuit It is the power circuit equipped with the above, and connects with said main switch via an actuation circuit, and it has the 1st time constant circuit which makes an input signal a reference pulse of said main-switch control circuit, and the 2nd time constant circuit which is connected to said synchronous detector via an inverting circuit, and makes an input signal a reference pulse of said main-switch control circuit, said reference pulse is divided into two phases, and it is characterized by preparing an idle period between driving pulses which drive said main switch and said synchronous detector, respectively.

[Claim 2] A power circuit according to claim 1 which has the 1st time constant circuit which said 1st time constant circuit containing a resistor and a capacitor connects diode to said resistor and juxtaposition, and makes discharge rapidly in a trailing edge of said reference pulse.

[Claim 3] A power circuit according to claim 1 which has the 2nd time constant circuit which said 2nd time constant circuit containing a resistor and a capacitor connects diode, and makes charge said resistor and juxtaposition rapidly in first transition of said reference pulse.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the power circuit by the actuation method of the synchronous detector by the side of commutation especially about the power circuit by synchronous detection of MOSFET.
[0002]
[Description of the Prior Art] First, the main switch of switching power supply using the conventional general MOSFET as an object for rectification, the synchronous detector by the side of [MOSFET] commutation, and an example of a power circuit that has an actuation control circuit including a main-switch control circuit are shown in drawing 3 .
[0003] The reference pulse of the main-switch control circuit 4 is inputted into the coupling circuit 5, and is inputted into the gate by the side of [MOSFET / 9] commutation via an inverter 6 and the synchronous detection actuation circuit 7. When the driving pulse by the side of [MOSFET / 9] commutation minds an inverter 6 for the reference pulse of the main-switch control circuit 4, the actuation synchronizes with a reference pulse, and completely operates reverse with the driving pulse of a main switch 1. Therefore, when a main switch 1 is ON, the commutation side MOSFET 9 will be in an OFF state, and energy is supplied to an output side from the input side of a power supply through rectifier diode 8. Moreover, when a main switch 1 is OFF, rectifier diode 8 will be in an OFF state, and energy is supplied to an output side by the commutation side FET 9 from a choke coil 10 by being turned on.
[0004]
[Problem(s) to be Solved by the Invention] In the conventional actuation control circuit mentioned above, although the inverter was used in order to carry out actuation of a main switch, and actuation of the synchronous detector by the side of commutation to the opposite actuation, the phenomenon in_which of a main switch and the synchronous detector by the side of [MOSFET] commutation were turned on simultaneously happened according to the delay by actuation of the inverter, and the delay of operation by the parasitic capacitance of the gate of MOSFET used as a synchronous detector, and there was a problem to which the power-conversion effectiveness of a power circuit falls.
[0005] The object of this invention is offering the power circuit which prevents the power loss by the simultaneous ON state with the main switch by the delay of operation by the side of [MOSFET] commutation in the main switch of the switching power supply which used MOSFET as an object for rectification, MOSFET for commutation side synchronous detection, and the power circuit that has an actuation control circuit.
[0006]
[Means for Solving the Problem] In a main switch of switching power supply with which MOSFET was used for a power circuit of this invention as an object for rectification, a synchronous detector by the side of [MOSFET] commutation, and a power circuit which has an actuation control circuit including a main-switch control circuit The 1st time constant circuit which is connected to said main switch via an actuation circuit, and makes an input signal a reference pulse of said main-switch control circuit, Connect with said synchronous detector via an inverting circuit, and it has the 2nd time constant circuit which makes an input signal a reference pulse of said main-switch control circuit. Said reference pulse is divided into two

phases, and it is characterized by preparing an idle period between driving pulses which drive said main switch and said synchronous detector, respectively.
[0007] Moreover, said 1st time constant circuit containing a resistor and a capacitor connects diode to said resistor and juxtaposition, and has the 1st time constant circuit made to discharge rapidly in a trailing edge of said reference pulse.
[0008] Moreover, it has the 2nd time constant circuit which said 2nd time constant circuit containing a resistor and a capacitor connects diode, and makes charge said resistor and juxtaposition rapidly in first transition of said reference pulse.
[0009] That is, a power circuit of this invention establishes a time constant circuit for a reference pulse from a main-switch control circuit in a main switch and a synchronous detector by the side of [MOSFET] commutation, respectively, operates the reference pulse orthopedically to a square wave by actuation control circuit, and makes it a driving pulse, and it has a time constant circuit which prepares a dead time between waves of each driving pulse.
[0010]
[Embodiment of the Invention] Next, this invention is explained with reference to a drawing.
[0011] Drawing 1 is the circuit diagram showing one example of this invention. Moreover, drawing 2 is each part wave shown in drawing 1 . A different point from the thing of the conventional example shown in drawing 3 in this example connects the reference pulse outputted from the main-switch control circuit 11 to the time constant circuit which consists of diode 6, a resistor 5, and a capacitor 4, and connects that output with IC3 for actuation in the series circuit of the gate of a main switch 1. Furthermore, it is making the driving pulse of a main switch 1 and the synchronous detector 14 by the side of [MOSFET] commutation into a square wave, and preparing a dead time in each by connecting the reference pulse outputted from the main-switch control circuit 11 also to the time constant circuit which consists of diode 8, a resistor 7, and a capacitor 9, and connecting the output to an inverter 10, the coupling circuit 12, and the series circuit of the gate by the side of [MOSFETl4] commutation.
[0012] Next, actuation of the power circuit of the above-mentioned example is explained using drawing 2 . For drawing 2 (a), the reference pulse wave of the main-switch control circuit 11 and (b) are [the gate voltage waveform of a main switch 1 and (d of the input wave of IC3 for actuation and (c))] the input wave of an inverter 10, and the gating waveform of the (e) synchronous detector 14. Here, when the reference pulse of the main-switch control circuit 11 is set to Hi, it is drawing 2 by the time constant of a resistor 5 and a capacitor 4. - A wave as shown in (b) is inputted into IC3 for actuation. Furthermore, it is fabricated by the square wave by IC3 for actuation, and a main switch 1 is turned on with this pulse shape. Moreover, reference pulse wave (b) of the main-switch control circuit 11 makes the synchronous detection element 14 an OFF state by diode 8, the inverter 10, and the coupling circuit 12 at this time.
[0013] On the other hand, since the energy stored in the capacitor 4 will discharge via diode 6 if the reference pulse of the main-switch control circuit 11 is set to Lo, the output wave of IC3 for actuation serves as Lo, and a main switch 1 is turned off. The input of an inverter 10 is drawing 2 by the time constant of a capacitor 9 and a resistor 7 then. - It becomes the discharge wave shown in (d), and it is fabricated by the square wave via an inverter 10, and the synchronous detector 14 by the side of [MOSFET] commutation is turned on by this pulse.
[0014] Since the above actuation can protect the simultaneous ON state of both MOSFETs in this example by setting up the timing of the driving pulse of a main switch 1 and the synchronous detector l4 by the side of [MOSFET] commutation by the resistor 5, the capacitor 4 and the resistor 7, and the capacitor 9 and a synchronous detector is driven by the square wave,

operational stability becomes possible and the power loss by actuation can be improved. Moreover, since it also follows the driving pulse by the side of [MOSFET] commutation at the reference pulse of a main-switch actuation circuit even if the reference pulse of a main-switch control circuit changes, a dead time is not based on the input condition and load conditions of a power supply, but becomes fixed, is not influenced of input fluctuation but becomes fixed [actuation power].

[0015]

[Effect of the Invention] There is an effect referred to as stabilized and operating without abolishing the power loss by preventing being turned on [simultaneous] (a short circuit condition) both the aforementioned MOSFETs by the dead time, since it has the actuation control circuit which the power circuit of this invention makes a dead time for the reference pulse of a main-switch control circuit with the combination of a time constant circuit, IC for actuation or a time constant circuit, and an inverter, and drives a main switch and a synchronous detector, and being influenced by an input condition and load conditions, as having stated above.

TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to the power circuit by the actuation method of the synchronous detector by the side of commutation especially about the power circuit by synchronous detection of MOSFET.

PRIOR ART

[Description of the Prior Art] First, the main switch of switching power supply using the conventional general MOSFET as an object for rectification, the synchronous detector by the side of [MOSFET] commutation, and an example of a power circuit that has an actuation control circuit including a main-switch control circuit are shown in drawing 3 .

[0003] The reference pulse of the main-switch control circuit 4 is inputted into the coupling circuit 5, and is inputted into the gate by the side of [MOSFET / 9] commutation via an inverter 6 and the synchronous detection actuation circuit 7. When the driving pulse by the side of [MOSFET / 9] commutation minds an inverter 6 for the reference pulse of the main-switch control circuit 4, the actuation synchronizes with a reference pulse, and completely operates reverse with the driving pulse of a main switch 1. Therefore, when a main switch 1 is ON, the commutation side MOSFET 9 will be in an OFF state, and energy is supplied to an output side from the input side of a power supply through rectifier diode 8. Moreover, when a main switch 1 is OFF, rectifier diode 8 will be in an OFF state, and energy is supplied to an output side by the commutation side FET 9 from a choke coil 10 by being turned on.

EFFECT OF THE INVENTION

[Effect of the Invention] There is an effect referred to as stabilized and operating without abolishing the power loss by preventing being turned on [simultaneous] (a short circuit condition) both the aforementioned MOSFETs by the dead time, since it has the actuation control circuit which the power circuit of this invention makes a dead time for the reference pulse of a main-switch control circuit with the combination of a time constant circuit, IC for actuation or a time constant circuit, and an inverter, and drives a main switch and a synchronous detector, and being influenced by an input condition and load conditions, as having stated above.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the conventional actuation control circuit mentioned above, although the inverter was used in order to carry out actuation of a main switch, and actuation of the synchronous detector by the side of commutation to the opposite actuation, the phenomenon in_which of a main switch and the synchronous detector by the side of [MOSFET] commutation were turned on simultaneously happened according to the delay by actuation of the inverter, and the delay of operation by the parasitic capacitance of the gate of MOSFET used as a synchronous detector, and there was a problem to which the power-conversion effectiveness of a power circuit falls.

[0005] The object of this invention is offering the power circuit which prevents the power loss by the simultaneous ON state with the main switch by the delay of operation by the side of [MOSFET] commutation in the main switch of the switching power supply which used MOSFET as an object for rectification, MOSFET for commutation side synchronous detection, and the power circuit that has an actuation control circuit.

MEANS

[Means for Solving the Problem] In a main switch of switching power supply with which MOSFET was used for a power circuit of this invention as an object for rectification, a synchronous detector by the side of [MOSFET] commutation, and a power circuit which has an actuation control circuit including a main-switch control circuit The 1st time constant circuit which is connected to said main switch via an actuation circuit, and makes an input signal a reference pulse of said main-switch control circuit, Connect with said synchronous detector via an inverting circuit, and it has the 2nd time constant circuit which makes an input signal a reference pulse of said main-switch control circuit. Said reference pulse is divided into two phases, and it is characterized by preparing an idle period between driving pulses which drive said main switch and said synchronous detector, respectively.

[0007] Moreover, said 1st time constant circuit containing a resistor and a capacitor connects diode to said resistor and juxtaposition, and has the 1st time constant circuit made to discharge rapidly in a trailing edge of said reference pulse.

[0008] Moreover, it has the 2nd time constant circuit which said 2nd time constant circuit containing a resistor and a capacitor connects diode, and makes charge said resistor and juxtaposition rapidly in first transition of said reference pulse.

[0009] That is, a power circuit of this invention establishes a time constant circuit for a reference pulse from a main-switch control circuit in a main switch and a synchronous detector by the side of [MOSFET] commutation, respectively, operates the reference pulse orthopedically to a square wave by actuation control circuit, and makes it a driving pulse, and it has a time constant circuit which prepares a dead time between waves of each driving pulse.

[0010]

[Embodiment of the Invention] Next, this invention is explained with reference to a drawing.

[0011] Drawing 1 is the circuit diagram showing one example of this invention. Moreover, drawing 2 is each part wave shown in drawing 1 . A different point from the thing of the conventional example shown in drawing 3 in this example connects the reference pulse outputted from the main-switch control circuit 11 to the time constant circuit which consists of diode 6, a resistor 5, and a capacitor 4, and connects that output with IC3 for actuation in the series circuit of the gate of a main switch 1. Furthermore, it is making the driving pulse of a main switch 1 and the synchronous detector 14 by the side of [MOSFET] commutation into a square wave, and preparing a dead time in each by connecting the reference pulse outputted from the main-switch control circuit 11 also to the time constant circuit which consists of diode 8, a resistor 7, and a capacitor 9, and connecting the output to an inverter 10, the coupling circuit 12, and the series circuit of the gate by the side of [MOSFET14] commutation.

[0012] Next, actuation of the power circuit of the above-mentioned example is explained using drawing 2 . For drawing 2 (a), the reference pulse wave of the main-switch control circuit 11 and (b) are [the gate voltage waveform of a main switch 1 and (d of the input wave of IC3 for actuation and (c))] the input wave of an inverter 10, and the gating waveform of the (e) synchronous detector 14. Here, when the reference pulse of the main-switch control circuit 11 is set to Hi, it is drawing 2 by the time constant of a resistor 5 and a capacitor 4. - A wave as shown in (b) is inputted into IC3 for actuation. Furthermore, it is fabricated by the square wave by IC3 for actuation, and a main switch 1 is turned on with this pulse shape. Moreover, reference pulse wave (b) of the main-switch control circuit 11 makes the synchronous detection element 14 an

OFF state by diode 8, the inverter 10, and the coupling circuit 12 at this time.
[0013] On the other hand, since the energy stored in the capacitor 4 will discharge via diode 6 if the reference pulse of the main-switch control circuit 11 is set to Lo, the output wave of IC3 for actuation serves as Lo, and a main switch 1 is turned off. The input of an inverter 10 is drawing 2 by the time constant of a capacitor 9 and a resistor 7 then. - It becomes the discharge wave shown in (d), and it is fabricated by the square wave via an inverter 10, and the synchronous detector 14 by the side of [MOSFET] commutation is turned on by this pulse.
[0014] Since the above actuation can protect the simultaneous ON state of both MOSFETs in this example by setting up the timing of the driving pulse of a main switch 1 and the synchronous detector l4 by the side of [MOSFET] commutation by the resistor 5, the capacitor 4 and the resistor 7, and the capacitor 9 and a synchronous detector is driven by the square wave, operational stability becomes possible and the power loss by actuation can be improved. Moreover, since it also follows the driving pulse by the side of [MOSFET] commutation at the reference pulse of a main-switch actuation circuit even if the reference pulse of a main-switch control circuit changes, a dead time is not based on the input condition and load conditions of a power supply, but becomes fixed, is not influenced of input fluctuation but becomes fixed [actuation power].

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the power circuit of one example of this invention.
[Drawing 2] It is drawing showing the wave of each part of drawing 1 .
[Drawing 3] It is drawing showing the block diagram showing the power circuit of the conventional example.
[Description of Notations]
1 Main Switch
2 The Main Transformer
3 IC for Actuation
4 Nine Capacitor
5 Seven Resistor
6 Eight Diode
10 Inverter
11 Main-Switch Control Circuit
12 Coupling Circuit
13 Diode
14 Synchronous Detector
15 The Main Choke Coil